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ABSTRACT

This report describes how Educational Radio and Television of Iran (ERTI) can use economic and manpower projection data in its planning. A summary of the conclusions reached in regard to Iran's most important education and training needs is followed by discussion of the particular types of information needed by ERTI and its availability. The description of computer model for projecting Iranian manpower and educational needs as a function of national economic growth and development is appended. (VT)

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MANPOWER FORECASTING MODEL FOR EDUCATIONAL PLANNING

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

by

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and

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December 1976

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COMMUNICATION SATELLITE PLANNING CENTER
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Stanford, California

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MANPOWER FORECASTING MODEL FOR EDUCATIONAL PLANNING

A. INTRODUCTION

This report describes how Educational Radio and Television of Iran (ERTI) can use economic and manpower projection data in its planning. The recommendations made here are based on the assumption that ERTI activities should be selected to have the greatest possible effect on Iran's problems. An inherent consideration is the degree to which ERTI programs might affect Iran's economic development. That in turn requires understanding of the major obstacles to development created by the lack of adequate education and training programs.

This report is the final step in a series of activities undertaken by the Stanford study team to gain an understanding of how ERTI programs might affect economic development. The first step was an initial analysis of the manpower levels required to support economic growth as projected by the Plan and Budget Organization (Ref. 1). The results showed the occupational categories with the most serious bottlenecks to development in the availability of trained manpower.

The second step was more detailed, involving modification and use of F. Vakil's macroeconomic projection program from the Plan and Budget Organization and comparative manpower data from other countries. This modeling activitity was necessary because the information available at the time from the Plan and Budget Organization was not sufficiently detailed to allow conclusions on training and education needs. The results of the analysis substantiated the earlier conclusions (Appendix A).

The Plan and Budget Organization has since extended its analyses to provide similar information. Improvements in the models go beyond what Stanford accomplished in the second step and provides the capability to develop the information needed by ERTI.

This report first summarizes the conclusions reached in regard to Iran's most important education and training needs, and the role that such information should play in ERTI's planning. Subsequent sections discuss the particular types of information needed by ERTI and its availability.

B. KEY FINDINGS AND RECOMMENDATIONS

1. Key Findings

The main substantive conclusions from the Stanford computer runs and the updated Plan and Budget Organization analysis are as follows:

- College and university programs for the professional, technical, administrative and managerial fields must be expanded more than the others. Annual rates of growth on the order of 10 percent are needed for these priority areas.

- Labor substitution plays a major role in meeting the need for specific middle and lower level skills. Retraining takes place in short programs or on the job. This means that the major factor in having such skilled manpower available is expansion of the elementary and secondary education system to create a trainable labor force. Training programs for these skill levels should be allowed to expand or contract in response to labor market conditions. Therefore, major government programs would in most cases be inappropriate. It would be better for the institutions requiring specific skills to set up their own training programs as needed.

These findings demonstrate how economic projection information can be useful to ERTI in setting priorities on its own activities. While the conclusions stated above are broad, they still have important implications for ERTI.

First, consider the identification of the areas of greatest need for expansion in higher education. This implies that ERTI should be involved in programs which would permit selective expansion of the management, administrative, professional and technical fields. By just assessing the role of TV in university expansion, without considering the role of national priorities, TV would be focussed on core courses common to all the university's programs. (See Ref. 2 for a description of that analysis.) However, with the conclusion here on the need for selective expansion, the use of TV would have to be planned somewhat differently.

In institutions with specialization in the desired subject areas the straight application of TV to core courses would be desired. For other institutions, the TV planning might focus within schools such as engineering and business. Or, if university-wide core courses are given

by TV, enrollments could be constrained except in the degree programs desired for expansion. Resources saved in the constrained degree programs could be applied in the areas where they are most needed. The analysis required for making such an assessment would follow that of Ref. 2, but with changes in the allowable pattern of expansion.

The second conclusion presented here implies that ERTI should focus more on supporting the expansion of elementary and secondary education than on direct occupational training. The economic analysis shows that the need for specific training programs can change rapidly. Therefore, the useful life of media, whether broadcast or non-broadcast might be short and the investment required to use media may not be warranted. The situation is further complicated by the need to tailor media-based occupational training programs to the particular job setting (Ref. 3). In terms of meeting Iran's economic development objectives, ERTI should, therefore, become involved only in occupational training programs that (1) are important and cannot meet the need without media support, or (2) offer some prospect of long term stability. The first criterion is a function of the availability of qualified instructors and the role the media would play in training. The second criterion is dependent on labor market variations. The information describing those variations must come from the type of analysis discussed in this report.

The more significant issue is the relative use of ERTI resources. The economic analysis is clear in pointing out the greater importance of providing a trainable base of people. Decisions by ERTI to participate in occupational training should therefore consider the impact of the same resources used in teacher training or other uses at the elementary and secondary level.

It is important to note that these conclusions are based on approximate economic projections. No models will ever give completely "accurate" forecasts, but can be expected to provide order of magnitude trends and general directions of education and training needs. In most cases this will be sufficient, since "accuracy" in terms of making exact predictions of the future is not a critical issue. The goal is to provide forecasts that, for a given economic investment plan, reduces the uncertainty of future outcomes to a level that dictates a <u>unique</u> decision by policy makers. If

the range of uncertainty in the forecasts is so large that contradictory policy decisions are compatible with it, the forecasts are of little use.

2. Recommendations

The economic projection information, even when based on rough estimates, can be useful in identifying education and training needs, in understanding the dynamics of the market for skills, and in appraising overall government policies which may affect ERTI's role. However, as can be seen from Appendix A, a substantial effort is needed to develop usable projections. It would be desirable for ERTI not to have to develop this information on its own.

Stanford prepared the projections described in Appendix A because the data were not available in the detail needed. Since that work was completed, the Plan and Budget Organization has taken on the job of routinely developing similar projections. Our basic recommendation from this work is that ERTI should arrange with the Plan and Budget Organization to routinely receive projections of education and training needs, and sufficient description of the changes expected in those needs to determine what programs it might undertake. ERTI's information needs are described in the following section.

C. INFORMATION NEEDS

To make decisions concerning program content and the scale of production and distribution, ERTI could use the following information.

- The growth of employment in different economic sectors as well as the economy overall.
- The occupational composition of the different economic sectors.
- The educational and skill requirements typical for each of the occupation categories, and the total need for graduates from various educational, vocational and other training institutions.
- The geographical distribution of the occupational categories, especially in the rural areas where media augmented education and training could be important.
- Demographic information on the potential work force. The age, sex and migration characteristics of the potential work force affect the need for education and training programs.

The typical time frame for these projections is five to ten years. ERTI, however, should establish the time frame most suited to its program decisions.

D. PROGRAMMING CAPABILITIES

This section reviews the models that are available now or will be available in the near future from the Plan and Budget Organization:

- Planometrics Group (PG)
  - National economic model. Among other things, it gives the investment required by seven major economic sectors to meet economic goals, and the value added in those sectors in response to different assumptions on government policies. There is usually a "most likely" scenario even though a number of runs may be presented.
  - Multi-level (sector) economic model which could provide (or eventually be expanded to provide) potentially more useful manpower information than is currently available.
- Manpower Planning Group (MPG)
  - Manpower planning model. This takes the results of the macro-economic model to forecast manpower needs by economic sector, educational level and occupation.
  - The MPG is working on further breaking out the manpower planning model by urban and rural categories.
  - They are also working on a model that will forecast sectoral job creation as a function of capital investment.

Tables I thru VI use sample outputs of these models to illustrate the type of information available as well as the ways in which that information can be used. It should be noted that the macroeconomic model output presented here is representative rather than the latest official forecast. At the time the output was provided, the Planometrics group was revising the forecasts.

Table I presents the economic growth and employment projections of the two basic models. The figures themselves are self-explanatory. The economic sectors of the two models do not correspond exactly but are sufficiently close to permit conclusions on areas of major growth.

Table II presents employment by sector in the urban and rural areas. Such information is important because of the different educational levels,

Table I

Macro-economic and Manpower Planning Model Outputs Based on GNP Growth Rate of 10.1%

Economic Sector \ Year		1978		1979		1980		1981		1982	
Macroeconomic Model	Corresponding MPP Model	Value Added (Constant 1351 Prices, billic.. rials)	Employment Projections (.000)	Value Added	Employment Projections	Value Added	Employment Projections	Value Added	Employment Projections	Value Added	Employment Projections
Agriculture	Agriculture	287.6	3400	301.9	3382.	317.0	3364.	332.9	334.6	349.5	3326.
Manufacturing and Mining	Indus-Modern try Trad.	420.4	941 / 1401	479.3	1063 / 1438	546.3	1196. / 1476	622.8	1326. / 1515.	710.0	1477. / 1555.
Construction	Construction	175.6	1198	202.8	1285.	234.2	1374.	270.5	1465.	312.5	1558.
Nat. Oil&Gas	Petroleum(1)	1051.7	20	1088.5	14.	1126.6	9.	1166.0	6.	1206.8	4.
Water&Power	Energy(1)	44.5	89	50.8	88.	57.9	88.	66.0	87.	75.2	86.
Transport &Communication	Transport(1)	151.0	404	173.6	419.	199.7	436.	229.6	453.	264.1	473.
Other Services	Modern Services										
	Traditional Services	1042.4	719 / 725 / 947 / 378 — 2769	1188.4	742 / 720 / 983 / 394 — 2839	1354.	766 / 715 / 1025 / 413 — 2919	1544.4	793 / 709 / 1068 / 432 — 3002	1760.6	819 / 704 / 1118 / 454 — 3095
	Trade										
	Admin.										
TOTAL		3173.2	10222	3485.3	10628	3836.4	10862	4232.2	11200	4678.7	11574

(1) These categories do not correspond exactly

Sources: Value added projections from Plan and Budget Organization: Planometrics Group, Sept. 1976.

Employment projections from Plan and Budget Organization: Manpower Planning Group, Manpower Forecasting Model, Sept. 1976.

Table II

Urban/Rural (U/R) Employment Changes Based on 1972 U/R Distribution and Table I

Economic Sector	Percent of Sector's Employment in U/R Areas(1)	('000) Employment (Based on Table I)									
		1978		1979		1980		1981		1982	
		U	R	U	R	U	R	U	R	U	R
Agriculture	3/97	102	3,298	100	3,281	101	3,263	100	3,246	100	3,226
Manufacturing & Mining	58/42	1,358	984	1,451	1,050	1,550	1,122	1,648	1,193	1,758	1,273
Construction	59/41	707	491	758	527	810	562	864	601	919	639
Transport & Comm.	83/17	335	69	348	71	361	74	376	77	393	80
Nat. Oil & Gas	Not Avail.										
Water & Power	89/11	79	10	78	10	78	10	77	10	77	9
Other Services	84/16	2,326	443	2,385	454	2,452	467	2,521	480	2,599	495
TOTAL		4,907	5,295	5,120	5,393	5,352	5,499	5,586	5,607	5,846	5,722

Note: U/R percent for each sector total 100%. This information was taken from the Statistical Yearbook 1974, and is based on data from 1972. Proportions are assumed constant throughout a 5 year period.

Table III

Manpower Planning Group's Employment Projections
by Professions (1000's)

Year / Profession	1978	1979	1980	1981	1982
Professional & Technical Workers	498	564	603	646	691
Technicians	299	352	383	416	453
Directors	21	26	29	33	37
Administrative Staff	475	541	578	619	662
Vendors	898	973	1,015	1,060	1,105
Others	8,431	8,895	9,153	9,422	9,682
TOTAL	10,319	10,999	11,379	11,779	12,177

Table IV

Possible Scenario for the Occupational Distribution of Workers by Sector: 1982

Sector \ Occupation	Professional Technical & Related	Managers & Admins.	Clerical Workers	Sales Workers	Service Workers	Agricultural Workers	Miners & Quarry-men	Transport Equipment Operators & Related	Industrial & Production	TOTAL
Agriculture, etc.	33,260	-	-	-	-	3,126,440	-	33,260	66,520	3,326,000
Manufacturing and Mining	212,240	151,600	363,840	90,960	60,640	-	60,640	121,280	1,970,800	3,032,000
Construction	77,900	171,380	62,320	-	15,580	-	-	62,320	1,152,920	1,558,000
National Oil and Gas	.240	.160	.520	.80	.80	-	.80	.700	2,640	4,000
Utilities (Water & Power)	7,740	4,300	16,340	860	1,720	-	-	6,020	49,020	86,000
Transport & Communication	14,190	28,380	99,330	4,730	14,190	-	-	193,930	118,250	473,000
Other Services (Commerce, Trade, etc.)	502,351	9,804	451,576	908,412	898,752	61,098	-	83,108	179,895	3,095,000
TOTAL	848,221	365,624	993,926	1,005,042	991,262	3,187,538	60,720	500,118	3,540,045	11,492,496

Notes: Although this was done for 1982 only, the above could be repeated for each year by changing (Table V) coefficients to reflect increasing skill intensity in each occupation.

Source: Table V coefficients times the 1982 economic sector totals from Table I.

For comparison with 1972 levels see Appendix A, Table 3, page A-6.

Table V

Projected Occupational Distribution of Workers Required by Each Sector: 1982

Occupation / Industry	Professional, Technical & Related	Managers & Administrators	Clerical Workers	Sales Workers	Service Workers	Agricultural Workers	Miners & Quarrymen	Transport Equipment Operators & Related	Industrial and Production
Agriculture, Forestry, & Related	.01 (-)	--- (-)	--- (-)	--- (-)	--- (-)	.94 (.99)	--- (-)	.01 (-)	.02 (.01)
Mining and Manufacturing	.07 (.01)	.05 (.01)	.12 (.02)	.03 (.01)	.02 (.03)	--- (-)	.02 (-)	.04 (.03)	.65 (.88)
Oil	.06 NAD	.04 NAD	.13 NAD	.02 NAD	.02 NAD	-- NAD	.02 NAD	.05 NAD	.66 NAD
Construction	.05 (.01)	.11 (-)	.04 (.02)	--- (-)	.01 (.01)	--- (-)	--- (-)	.04 (.03)	.74 (.93)
Electricity & Utilities	.09 (.10)	.05 (-)	.19 (.27)	.01 (.01)	.02 (.14)	--- (-)	--- (-)	.07 (.05)	.55 (.43)
Commerce Trade	.02 (.02)	.04 (-)	.15 (.07)	.60 (.84)	.06 (.02)	--- (-)	--- (-)	.04 (.04)	.09 (.01)
Transport, etc.	.03 (.01)	.06 (.01)	.21 (.12)	.01 (-)	.03 (.04)	--- (-)	--- (-)	.41 (.57)	.24 (.25)
Services	.33 (.24)	.06 (-)	.15 (.19)	.01 ---	.32 (.44)	.01 (.03)	--- ---	.02 (.02)	.11 (.08)
Activities not Adequately Described	.01 (Not really needed -)	.01	.01	---	.01	.01	---	---	.03

(Rows add to 1.00)

Source: 1) Statistics of the Occupational and Educational Structure of the Labor Force in 53 Countries, OECD, Paris, 1969.

2) Manpower Requirements for Planning: An International Comparison Approach, Vol. I, Horowitz, Zymelman, Herrnstadt, N.W. Univ. Dec. 1966.

3) Labor Statistic Yearbook 1972.

Notes: 1) The lower parenthetical entries represent best estimates derived from Source 3). The upper entries, assumed for 1982, were derived from all three of the sources but reflect the 1960 U.S. situation most.

2) (-) implies less than (.009).

Table VI

Manpower Planning Group Employment by Education
(10.1% GNP Growth Assessment (1,000's)

Educational Level \ Year	1978	1979	1980	1981	1982
Illiterate and Incomplete Primary	5,452	5,416	5,362	5,279	5,146
Primary	2,937	3,143	3,371	3,624	2,898
Incomplete Secondary	801	626	654	683	714
Secondary	853	929	1,014	1,110	1,217
Up to Masters	522	573	632	698	772
Masters & PhD	282	312	347	386	432
TOTAL	10,646	10,999	11,379	11,779	12,177

Source: Plan and Budget Organization: Manpower Planning Group, Manpower Forecasting Model.

age profiles and industry character in the urban and rural sectors. This implies that ERTI should have an active interest in the urban-rural breakdown that the manpower planning people are currently developing. They will likely, based on the recent census and demographic trends, be able to provide a standard forecast along the lines of Table II that would meet NIRT's needs.

Table III presents the current MPG models' output for the growth in professions by year. This output is useful since it is based on the macroeconomic forecasts. However, it is possible using available data, and would be more useful to ERTI, to define the occupations or professions more in line with the categories shown in Table IV.

Table IV, based on the coefficients of Table V and the totals of Table I, gives a more useful breakdown than Table III of the information required to make training and educational programming decisions. While Table IV is useful as is, it could be further expanded with surveys and the latest census data to give occupational trends which provide order of magnitude estimates which distinguish urban and rural needs. A useful study along these lines was done by B. Abadian (Ref. 4) where the rural occupations and activities were studied and categorized in great detail.

Since these studies are time-consuming, it would be important for ERTI to receive support from the Plan and Budget Organization. The latter has the tools, the personnel and the ability to obtain needed data more efficiently than ERTI. In requesting routine information, however, the arguments presented here should be used by ERTI to justify the request. For specific program areas requests, ERTI should first estimate the potential benefits for an investment and use that to justify the time and effort needed for Plan and Budget.

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[1] Vakil, F., "A Macro-Economic Projection for Iran," Plan and Budget Organization, distributed in NIRT Prospectus Project Seminar, Mashad, Iran, June 1975.

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[3] Feilders, John, The Use of Media in Occupational Training in Iran, Technical Report No. 17, Communication Satellite Planning Center, Stanford University, Stanford, California, December 1976.

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APPENDIX A

MODEL DEVELOPMENT

A. INTRODUCTION

This report describes a model for projecting Iranian manpower and educational needs as a function of national economic growth and development. The model is designed to be used as a tool by educational planners in determining the educational and training implications of alternative national economic expansion paths. The major concern is to identify bottlenecks in the education system which could adversely affect the development of Iran's economy.

Key findings from the initial runs of the program are presented in the following section. Subsequent sections describe the model, and discuss the initial results in some detail. The final section discusses potential applications of the model. Program listings are attached.

B. KEY FINDINGS

Some significant results were found from the initial computer runs:

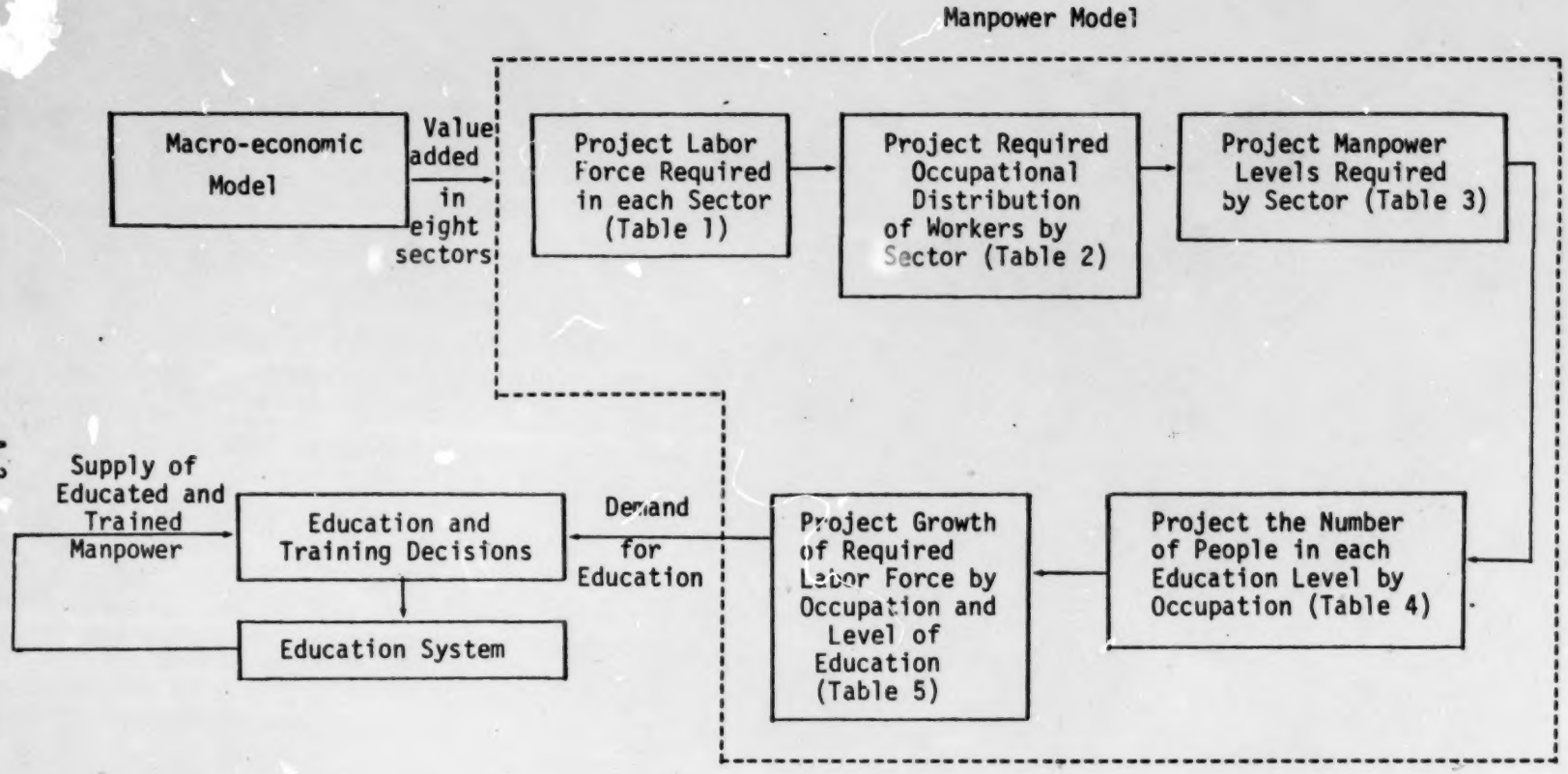
- College and university programs for the professional, technical, administrative and managerial fields must be greatly expanded. Annual rates of growth of 13 percent are needed for the professional and technical fields, and 38 percent for the administrative and managerial.

- Labor substitution plays a major role in meeting the need for specific middle and lower level skills. Retraining takes place in short programs or on the job. This means that the major factor in having such skilled manpower available is expansion of the elementary and secondary education system to create a trainable labor force. Training programs for these skill levels should be allowed to expand or contract in response to labor market conditions.

C. MODEL DESCRIPTION

The manpower model projects the growth of the employed labor force by occupation and level of education. The steps taken in the program are shown in Fig. 1. They are related to a series of tables containing the data used in the computations as well as sample results (Tables 1-6).

The input to the program consists of the value added to the economy in eight sectors: (1) agriculture, (2) mining and manufacturing, (3) oil,


Manpower Model
Macro-economic Model
Value added in eight sectors
Project Labor Force Required in each Sector (Table 1)
Project Required Occupational Distribution of Workers by Sector (Table 2)
Project Manpower Levels Required by Sector (Table 3)
Supply of Educated and Trained Manpower
Education and Training Decisions
Education System
Demand for Education
Project Growth of Required Labor Force by Occupation and Level of Education (Table 5)
Project the Number of People in each Education Level by Occupation (Table 4)

A-2

Fig. 1 Block Diagram of the Manpower Model

(4) utilities, (5) construction, (6) commerce, (7) transportation, and (8) services. Table 1 shows the value added in 1972 used in the first series of runs. These numbers were computed from an extended version of the macroeconomic model developed by F. Vakil of the Plan and Budget Organization [1]. A listing of Vakil's program is contained in Appendix A.

The rate of growth of value added is used to estimate the labor force required in each sector in the target year. Table 1 shows the results for 1982, and identifies both the computation procedure and the sources of data.

Estimated manpower requirements are then broken down by broad occupational category and educational level as follows:

- Table 2 projects the occupational distribution in each sector in 1982, expressed in percentages, based on occupational mixes in Iran in 1972 and international comparisons.
- Table 3, based on Tables 1 and 2, projects the occupational composition of the labor force by economic sector in 1982 and compares it with the 1972 situation.
- Table 4 gives the percentage of people in each occupation whose highest educational attainments correspond to each of four educational levels. The levels are higher education, 4 years and more; secondary, indicating completion of high school or one or two years of college; elementary, indicating eight years of schooling; and illiterate or read only. Both the 1972 situation and the assumed values for 1972-1982 are given in Table 4.
- Table 5 summarizes the results of this particular set of projections with regard to both levels of education and occupation. (Table 7 summarizes similar results for all of the model runs).
- Table 6 gives an overview of the demands on the education system if the projections of entrants into the different occupational classifications are to be achieved.

There are some key assumptions in the manpower model that should be noted. First, the estimates of productivity growth (Table 1 - column 5), the occupational structure (Table 2), and the output in each industry (Table 1 - column 2) are all assumed to be independent.

Second, as reflected in Table 2, the net additions to the labor force are assumed to have a more skill-intensive occupational composition

Table 1

Statistical Linking of Sectoral Output and Manpower Projections for 1980

Economic Sector	(1) Value Added 1972 Current Prices	(2) Projected Output 1982 (1972 prices)	(3) Projected Rate of VA Growth (%)	(4) Avg. Rate Productivity Growth (1959-1973)	(5) Assumed Rate of Productivity (1972-1982)	(6) Implied Rate of Labor Force Growth (%)	(7) Ratio of Labor Force Needed 1972 vs.1982 (approx.)	(8) Estimated Labor Force 1972 (thousands)	(9) Estimated Labor Force 1982 (thousands)
Agriculture	200.0		5.0	4.5	6.0	-1.0	0.90	3654	3289
Mining & Manufacturing	151.6		17.0	6.0	8.0	+11.0	2.65	1890	5009
Oil	331.4		3.0	18.1 (1959-1967)	2.5	+1.5	1.16	50	58
Utilities	18.4		20.0	NAD	12.0	+8.0	2.16	80	173
Construction	63.4		14.2	NAD	5.0	+9.0	2.40	710	1704
Commerce	80.0		8.0	NAD	3.0	+5.0	1.63	790	1288
Transport	45.0		10.5	-0.6	3.0	+6.5	1.85	440	814
Services	408.8		17.0	5.6	12.0	+5.0	1.63	1510	2461
TOTAL (Avg.)	1298.6		(11.8)		(6.4)	(5.4)	1.65	9129	14796

Sources and Notes:

Column 1. Sources: (a) "Economic Statistics and Trends of Iran," Iran Statistical Research Unit, 1st Ed., Sept. 1975, Table 6, p. 32.
(b) "Employment and Income Policies for Iran," Mission Working Paper No. XII, ILO, Feb. 1973, Table V.6, p. 113.
(c) "A Macro-Econometric Projection for Iran," F. Vakil, Table I (Initial Values, 1351).
Note: Minor adjustments made to several entries, based on historical relationships, to account for omissions in and comparison of data sources.

Column 2. Output projections varied significantly depending on the source, assumptions, initial conditions, and policy objectives. The projected rate of growth of V.A.(3) is used to circumvent this. Column 2 would be used (and from it and Column 1, obtain Column 13, etc.) when some final, "best guess" forecasts, based on current government plans, are made by the Planometrics group.

Column 3. Based on historical trends from sources 1(a); 1(b); 1(c); Runs I, II, and III; and:
(a) A Review of Iran's Development Prospects, by Bahman Abadian, Mar. 31, 1974, Table 3, p. 15.
Notes: The RSG of "Oil" is high (13.) in the years up to 1980 and then slows considerably (0.4 by 1992 by one estimate); "3.0" is, therefore, a low average -- error in this entry should not be critical, however, given the small level of employment involved.
Large increase in services and manufacturing of course reflect the structural transformation concomitant with economic development; the services sector, in most countries classification schemes is also a catch-all for entries not classified in other sectors.

Column 4. Sources: 1(a): Tables 16, 24, 26; 1(b): Table IV.10; and Amuzegar, J. and Fekrat, A.M., Iran: Economic Development Under Dualistic Conditions, University of Chicago Press, 1971, p. 100, Table 4.7.
Note: Entries are averages unless otherwise noted.

Column 5. Note: Based in part on international comparisons, and "Perspective of Manpower and Employment Planning: Iran (1972-1992)," Plan and Budget Organization, Pop. and Manpower Bureau, March 1973, Tables 7, 8, 9, 10, 11, 13.

Column 6. Column 6 = Column 3 - Column 5.

Column 7. Compound equivalent of Column 6 for 10 years.

Column 8. Based on 1973 ILO study, 1(b), Table V.10, p. 119; and 1(a), Table 24, p. 71.

Column 9. Column 9 = Column 7 x Column 8.

Table 2

Projected Occupational Distribution of Workers Required by each Sector: 1982

Occupation / Industry	Professional, Technical & Related	Managers & Administrators	Clerical Workers	Sales Workers	Service Workers	Agricultural Workers	Miners & Quarrymen	Transport Equipment Operators & Related	Industrial and Production
Agriculture, Forestry, & Related	.01 (-)	--- (-)	--- (-)	--- (-)	--- (-)	.94 (.99)	--- (-)	.01 (-)	.02 (.01)
Mining and Manufacturing	.07 (.01)	.05 (.01)	.12 (.02)	.03 (.01)	.02 (.03)	--- (-)	.02 (-)	.04 (.03)	.65 (.88)
Oil	.06 NAD	.04 NAD	.13 NAD	.02 NAD	.02 NAD	--- NAD	.02 NAD	.05 NAD	.66 NAD
Construction	.05 (.01)	.11 (-)	.04 (.02)	--- (-)	.01 (.01)	--- (-)	--- (-)	.04 (.03)	.74 (.93)
Electricity & Utilities	.09 (.10)	.05 (-)	.19 (.27)	.01 (.01)	.02 (.14)	--- (-)	--- (-)	.07 (.05)	.55 (.43)
Commerce Trade	.02 (.02)	.04 (-)	.15 (.07)	.60 (.84)	.06 (.02)	--- (-)	--- (-)	.04 (.04)	.09 (.01)
Transport, etc.	.03 (.01)	.06 (.01)	.21 (.12)	.01 (-)	.03 (.04)	--- (-)	--- (-)	.41 (.57)	.24 (.25)
Services	.33 (.24)	.06 (-)	.15 (.19)	.01 ---	.32 (.44)	.01 (.03)	--- ---	.02 (.02)	.11 (.08)
Activities not Adequately Described	.01 (Not really needed →)	.01	.01	---	.01	.01	---	---	.03

(Rows add to 1.00)

Source: 1) Statistics of the Occupational and Educational Structure of the Labor Force in 53 Countries, OECD, Paris, 1969

2) Manpower Requirements for Planning: An International Comparison Approach, Vol. I, Horowitz, Zymelman, Herrnstadt, N.W. Univ. Dec. 1966.

3) Labor Statistic Yearbook 1972.

Notes: 1) The lower parenthetical entries represent best estimates derived from Source 3). The upper entries, assumed for 1982, were derived from all three of the sources but reflect the 1960 U.S. situation most.

2) (-) implies less than (.009).

Table 3

Projected Occupation of Employed Labor Force by Sector in 1982 Compared to Estimated Situation in 1972

A. Estimated Situation, 1972

Occupation / Sector	Professional, Technical & Related	Managers & Administrators	Clerical Workers	Sales Workers	Service Workers	Agricultural Workers	Miners & Quarrymen	Transport Equipment Operators & Related	Industrial and Production	TOTAL
Agriculture, Forestry, & Related	494	330	3,856	182	3,986	3,629,563	---	---	15,428	3,653,839
Mining and Manufacturing	17,037	7,391	40,460	23,505	58,626	4,173	9,056	56,672	1,660,916	1,884,836
Oil	3,000	2,000	6,500	1,000	1,000	---	1,000	7,000	28,000	49,500
Construction	10,103	2,106	11,915	1,007	4,298	903	---	21,289	657,985	709,606
Electricity & Utilities	8,185	---	24,595	1,118	11,120	170	---	3,998	31,312	80,498
Commerce, Trade	13,785	709	52,250	670,360	13,345	446	---	31,561	7,392	789,848
Transport, etc.	5,469	3,694	51,882	2,325	17,127	1,203	---	251,523	106,599	439,822
Services	359,519	6,577	283,322	4,693	654,530	44,957	---	30,198	126,291	1,510,037
Activities not Adequately Described	1,492	270	4,174	4[illegible]	3,244	539	---	---	6,145	16,313
TOTAL	419,084	23,077	478,954	709,639	767,276	3,681,954	10,056	404,241	2,640,068	9,134,429

Source: Based on proportions from Iran's Labor Statistics Book: 1972, but totals agree with those in Economic Statistics & Trends of Iran, Sept., 1975, since the latter totals are assumed to be more accurate and were used earlier. (Oil breakdown estimated.)

NOTES: (---) implies low enough to be "not recorded." There is a slight discrepancy in totals; see write up.

B. Projected Requirements in 1982

Occupation / Sector	Professional, Technical & Related	Managers & Administrators	Clerical Workers	Sales Workers	Service Workers	Agricultural Workers	Miners & Quarrymen	Transport Equipment Operators & Related	Industrial and Production	TOTAL
Agriculture, Forestry, & Related	32,890	---	---	---	---	3,091,660	---	32,890	65,780	3,289,000
Mining and Manufacturing	350,630	250,450	601,080	150,270	100,180	---	100,180	200,360	3,255,850	5,009,000
Oil	3,480	2,320	7,540	1,160	1,160	---	1,160	2,900	38,280	58,000
Construction	85,200	187,440	68,160	---	17,040	---	---	68,160	1,260,960	1,704,000
Electricity & Utilities	15,570	8,650	32,870	1,730	3,460	---	---	12,110	95,150	173,000
Commerce, Trade	25,760	51,520	193,200	772,800	77,280	---	---	51,520	115,920	1,288,000
Transport, etc.	24,420	48,840	170,940	9,140	24,420	---	---	333,.40	195,360	814,000
Services	812,130	147,660	369,150	24,610	787,520	24,610	---	49,220	270,710	2,461,000
Activities not Adequately Described	1,492	270	4,174	449	3,244	539	---	---	6,145	16,313
TOTAL	1,351,572	697,150	1,44, 114	959,159	1,014,304	3,116,809	101,340	750,900	5,304,155	14,796,000*

Source: Column (9), Table I multiplied by coefficients in Table 2; Not Adequately Specified workers of 1972 transferred without change in 1982.

* 14,796,000 is total from Table I; the total row and column do not add exactly to it due to rounding error (can be corrected as data improves)

A-7

Table 4

Educational Levels or a Fraction of People Active in each Occupation in 1972 and Projected Numbers of Educated People Required to Attain Identical Proportions in 1980

A. Percent Distribution by Educational Level in Each Occupation: 1972[1]

Education / Occupation	Higher Education (4 yrs.+)	Secondary (H.S. &/or 1-2 years College)	Elementary	Illiterate or Read Only
Professional, Technical & Related	.35 (.45)	.48 (.45)	.15 (.10)	.02 (---)
Managers & Administrators	.18 (.20)	.46 (.51)	.31 (.29)	.05 (---)
Clerical & Related	.04 (.05)	.54 (.67)	.40 (.28)	.02 (---)
Sales	--- (.05)	.15 (.45)	.60 (.50)	.25 (---)
Service	--- (.02)	.10 (.26)	.55 (.72)	.35 (---)
Agriculture	--- (.02)	.05 (.21)	.40 (.77)	.55 (---)
Mining and Production	--- (.01)	.05 (.29)	.50 (.70)	.45 (---)
Transport, etc.	NAD (.01)	NAS (.33)	NAD (.66)	NAD (---)
Not classified by Occupation	.03 (NR)	.18 (NR)	.34 (NR)	.45 (NAD)

NOTE: 1) 1972 data for Iran not available. Table is derived from Iran 1966 data (Statistical Yearbook, 1966, Statistical Center of Iran, Table No. 33, p.110) and international comparison for educational structures in countries with similar productivity and occupational mix growth rates. (Statistics of the Occupational and Educational Structure of the Labor Force in 53 Countries, OECD, Paris, 1973)
2) (---) = less than .009
3) (.xx) entries represent target values for 1982; international comparison
4) NR = Not Relevant; NAD = Not Available Data

B. Projected Numbers Required in 1982 to Maintain Target Proportions

Professional, Technical & Related	608,207	608,207	135,157	---
Managers & Administrators	180,646	460,647	261,937	---
Clerical & Related	74,931	1,004,084	419,617	---
Sales	27,994	251,946	279,936	---
Service	21,832	283,812	785,940	---
Agriculture	62,336	654,530	2,399,942	---
Mining & Production	54,570	1,582,534	3,819,910	---
Transport, etc.	7,509	247,797	495,594	---
Not classified by Occupation	489	3,588	12,234	---
TOTAL	1,038,514	5,097,145	8,610,267	---

Source: 1982 Totals from Table 3 times fractions from Part A, above.

NOTES: 1) Not classified by Occupation approximated in the transfer only.
2) Again, total work force doesn't exactly equal that from Table 3, due to rounding.
3) These numbers could vary depending on assumptions on classification and cut-off for the education level. (Most countries do it differently.)

Table 5

Projected Growth of Employed Labor Force by Occupation; Level of Education

A. Growth in Numbers Required in Each Occupation (approximate)

	Number in 1972	Number in 1982	Approx. Annual Growth Rate 1972-1982	Total Number Added	Average Annual Increase
Professional, Technical, & Related	419,084	1,351,572	12%	932,488	93,249
Managers & Administrators	23,077	697,150	38%	674,073	67,407
Clerical & Related	478,954	1,447,114	13%	968,160	96,816
Sales	709,639	959,159	3%	249,520	24,952
Service	767,276	1,014,304	3%	244,028	24,403
Agriculture	3,681,954	3,116,809	-1%	(565,145)	(56,515)
Mining and Production	2,660,124	5,405,495	6%	2,745,371	274,537
Transport, etc.	399,241	750,900	7%	351,659	35,166
TOTAL	= 9,134,429	= 14,796,000	5%	5,600,154	560,015

B. Growth in Numbers Required at Each Level of Education to Maintain Target Proportions

	Number in 1972	Number in 1982	Approx. Annual Growth Rate 1972-1982	Total Number Added	Average Annual Increase
Higher Education	169,337	1,038,514	19%	869,187	86,919
Secondary	1,065,658	5,097,145	17%	4,031,487	403,149
Elementary	4,052,169	8,610,267	7%	4,558,198	455,820
Illiterate	3,786,266	---	-337%	(3,786,266)	(378,627)

Table 6

Projected Growth of Employed Labor Force by Occupation and Education Level

Education Level & Changes / Occupation	HIGHER EDUCATION				SECONDARY EDUCATION				ELEMENTARY EDUCATION			
	1972	1982	Total Added	Average Annual Growth Rate	1972	1982	Total Added	Average Annual Growth Rate	1972	1982	Total Added	Average Annual Growth Rate
Professional, Technical & Related	146,680	608,207	461,527	15%	201,160	608,207	407,047	12%	62,863	135,157	72,294	8%
Managers & Administrators	4,154	180,646	176,492	46%	10,615	460,647	450,032	46%	7,154	261,937	254,783	43%
Clerical & Related	19,158	74,931	55,773	15%	258,635	1,004,084	745,449	15%	191,582	419,617	228,035	8%
Sales	---	27,994	27,994	178%	106,446	251,946	145,500	9%	452,783	279,936	(145,847)	(5%)
Service	---	21,832	21,832	171%	76,727	283,812	207,084	14%	422,002	785,940	363,938	6%
Agriculture	---	62,336	62,337	201%	184,098	654,530	470,432	13%	1,472,782	2,399,942	927,160	5%
Mining and Production	---	54,570	54,570	198%	133,006	1,582,534	1,449,528	28%	1,330,062	3,819,910	2,489,848	11%
Transport, etc.	---	7,509	7,509	144%	NAD	247,797	NAD	NAD	NAD	495,594	NAD	NAD
TOTAL		1,038,514				5,097,145				8,610,267		

NOTES: "Not Classified" percentage included in totals; all numbers rounded.
Large increases in Agriculture, Service, Sales, Mining & Production in the above three educational categories will come in part from the "Illiterate or Read Only" class of Table 4, in addition to new entrants to the labor market.

than the people already in the sector. It is difficult to define what might be the optimum occupational mix in terms of maximum sectoral productivity for minimum educational cost. This difficulty is due to the current mix in Iran and elsewhere being as much a function of supply factors as of demand factors. That is, qualified manpower will generally be absorbed by the economy no matter how irrationally produced. The model must therefore be run for several sets of occupational compositions.

The third major assumption assumes that the occupational structure of an industry is determined by the state of technology in the industry, i.e., the price of "wage" elasticity is very low. This unrealistically implies that there can be no substitution between occupations in the production of output. The effect of this assumption is mitigated since the occupational category, as measured in this model, includes manpower with a variety of education backgrounds. Thus, changes in relative wages may generate adjustments in the relative numbers employed at different skill levels within the same occupational category, rather than in the relative numbers employed in the different occupational categories.

Finally, the model assumes that the educational structure of an occupation is rigidly determined by the state of technology in an industry. This implies that different kinds of education cannot be substituted for one another in the performance of various occupations. The effect of this assumption is mitigated due to the aggregation of educational requirements forecasts into the larger categories of Higher, Secondary, and Primary levels. (Appendix B lists the program.)

D. FEEDBACK BETWEEN THE MACROECONOMIC AND MANPOWER MODELS

The value added input that drives the manpower model comes from a macroeconomic model of the Iranian economy. Ideally, since the availability of qualified manpower and its productivity affects the value added (VA) in a given economic sector, the two models would be run together in a general equilibrium analysis. Unfortunately, current data limitations do not enable such an operation at this time.

To at least explore the interdependent relationship in a rudimentary way, the two models could be run interactively as follows (see Fig. 2). First, the econometric model would be run, and input the necessary

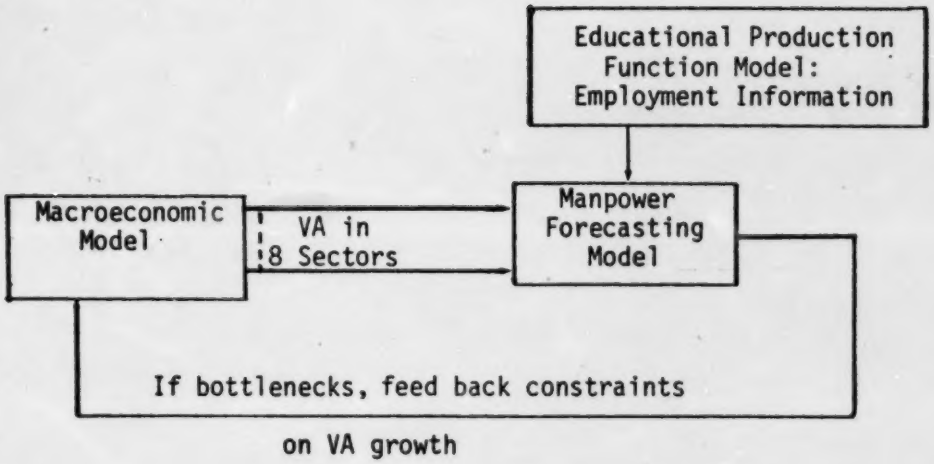


Fig. 2 Feedback Between Models

sectoral VA information to the manpower model. If the results of the manpower model predict bottlenecks exceeding specified thresholds, the econometric model would have to be rerun accounting for the existence of the bottleneck. The bottlenecks would be represented in the form of constraints on the rate of growth (ROG) of VA in the different economic sectors. The sector affected would be a function of the occupation/skill class affected and the severity of the bottleneck.

The modified econometric model output would then provide a new constrained set of VAs to the manpower model. The latter would then be run and the remaining bottlenecks, if any, would be observed. This iterative procedure would continue until all significant bottlenecks were eliminated. At that point, however, the VA in one or more sectors may have diverged too far from national objectives and cause planners to explore the effect of structural changes in the educational coefficients, or other ways to offset the original bottlenecks. Such actions, which relate to certain educational or economic policy decisions, could include one or more of the following: changes in occupational skill mix requirements, changes in occupational educational requirements, labor-labor substitution, capital-labor substitution, importing more temporary labor, government retraining or labor mobility assistance, or a general nationwide effort to increase productivity.

E. MODEL RUNS AND RATIONALE

To demonstrate the capability of the computerized model as a flexible tool to analyze different scenarios, and to test the sensitivity of the model's output to the key assumptions, several model runs were made. These runs, and their results, are described below. The use of the different runs for planning purposes is discussed in the following two sections.

Run #1: reflects the values of Table 1-4. There are some differences in the Table and computer run values due to rounding differences, the fact that the category "Not Adequately Specified" was not carried through on the computerized version (the total was prorated over the other categories), and the rate of growth calculations in the tables are approximate. The results of this run are discussed in Section F.

Run #2: was done to test the sensitivity of the model to variations in sectoral Value Added ROG (which enters independently from another model). This run was done assuming that the sectoral value added was half of the Run #1 values. As Table 7 indicates, the manpower-educational requirements are very sensitive to this variable. Since these rates are likely to be correlated with productivity, it is necessary to check what happens when Run 4 does this. Both VA growth rates and productivity values are varied.

Run #3: was done to ascertain the model's sensitivity to variation in sectoral productivity growth. The run was done assuming that sectoral productivity was half of the Run 1 values. Table 7 indicates that manpower and educational requirements are less sensitive to this variable than to the ROG of value added. This is an important result since available productivity measures, which are subject to more projection problems than are value added estimates, can be used with more confidence. A review of worldwide as well as Iranian trends also indicated that productivity grows at substantially different rates at different points in time. This fact favorably supports the model's use of a single mean sectoral productivity value over the ten year forecasting period. Although productivity is changed along with the ROG of value added in the next run, it also seems logical that productivity and the occupational structure is varied in Run #6 but the two are not varied together in any runs. They were not varied together since more work needs to be done in determining the nature of the dependency. As more information becomes available on this relationship, additional correlated runs should be made.

Run #4: was done with both productivity and value added at their halved value of Runs #2 and #1, respectively. Since these variables are likely to be correlated, this run gives a better lower bound picture than either Run #1 or Run #2 separately. Table 7 indicates a lower annual average growth rate of approximately 2%, which is much closer to the Iranian average for the 1956 to 1966 period.

Runs #5, 6, 7: As stated earlier, one of the key assumptions of the model is that there is no substitution between occupations in the

Table 7

Sensitivity Runs

	Number in 1972 (1351)	RUN #1 Number in 1982 (1361)	RUN #1 Annual Rate of Growth	RUN #1 Average Annual Change	RUN #2 Number in 1982	RUN #2 Annual Rate of Growth	RUN #2 Average Annual Change	RUN #3 Number in 1982	RUN #3 Annual Rate of Growth	RUN #3 Average Annual Change	RUN #4 Number in 1982	RUN #4 Annual Rate of Growth	RUN #4 Average Annual Change
Professional Tech. & Rel.	419,084	1,373,921	0.126	95,484	631,501	0.042	21,242	2,177,583	0.179	175,850	1,025,679	0.094	60,660
Adminis. & Managerial	23,077	582,316	0.381	55,924	283,097	0.285	26,002	849,273	0.433	81,720	411,709	0.334	38,863
Clerical,Rel.	479,035	1,622,410	0.13	114,338	816,833	0.05	33,780	2,274,389	0.17	179,535	1,148,864	0.09	66,983
Sales	709,639	957,842	0.03	24,820	608,842	**	-10,080	1,157,790	0.05	44,815	732,574	=0.00	2,293
Service	767,276	1,017,370	0.03	35,009	465,906	**	-30,137	1,666,863	0.08	89,959	781,334	=0.00	-32,628
Agriculture	3,681,954	3,197,023	0.01	-48,493	2,467,052	0.04	-121,490	4,318,890	**	63,694	3,355,670	0.01	57,160
Mining & Production	2,650,123	4,755,868	0.06	210,575	2,267,052	**	-38,535	6,662,139	0.10	401,202	3,221,724	0.02	57,160
Transport,etc.	404,241	811,685	0.07	40,744	453,027	0.01	4,879	1,035,734	0.10	63,149	577,677	0.04	17,344
TOTAL	9,134,429	14,318,430	0.05	518,400	7,991,027	**	-114,340	20,133,640	0.08	1,099,921	11,255,230	0.02	212,080
Higher Educa.	169,337	1,003,703	0.19	83,437	497,916	0.11	32,858	1,516,266	0.25	134,693	759,703	0.16	58,937
Secondary Ed.	1,065,658	5,016,234	0.17	395,058	2,695,309	0.10	162,965	7,067,458	0.21	600,180	3,803,693	0.14	273,804
Elementary Ed.	4,052,169	8,298,490	0.07	424,632	4,797,799	0.02	745,630	11,549,928	0.11	749,776	6,692,830	0.05	2,644,066
Illiterate	3,786,222	0	3.37	-378,622	0	3.37	-378,622	0	3.37	-378,622	0	3.37	-378,622

	Deviation from RUN #1	RUN #5			RUN #6			RUN #7		
Professional Tech. & Rel.	+	1,064,181	0.098	64,510	1,373,921	0.126	95,484	1,064,181	0.098	64,510
Adminis. & Managerial	+	203,490	0.243	10,141	582,316	0.381	55,924	203,490	0.243	10,141
Clerical,Rel.	+	1,121,433	0.09	64,240	1,622,410	0.13	114,338	1,121,433	0.09	64,240
Sales	+	1,206,728	0.05	49,709	957,842	0.03	24,820	1,206,728	0.05	49,709
Service	+	1,221,406	0.05	45,413	1,017,307	0.03	25,009	1,221,406	0.05	45,413
Agriculture	+	3,296,161	0.01	-38,579	3,197,023	0.01	-48,493	3,296,161	0.01	-38,579
Mining & Production	+	5,399,662	0.07	274,954	4,755,868	0.06	210,575	5,399,662	0.07	274,954
Transport,etc.	+	843,649	0.08	43,941	811,685	0.07	40,744	843,649	0.08	43,941
TOTAL	+	14,356,700	0.05	522,228	14,318,430	0.05	518,400	14,356,700	0.05	14,356,700
Higher Educa.		788,772	0.17	61,943	650,586	0.14	48,125	453,949	0.10	28,461
Secondary Ed.		4,731,112	0.16	366,545	2,527,673	0.09	146,202	2,032,290	0.07	96,663
Elementary Ed.		8,836,821	0.08	478,465	6,313,581	0.05	226,141	6,591,575	0.05	253,941
Illiterate		0	3.37	-378,622	4,826,589	**	104,037	5,278,889	**	149,267

** Program was not able to print value out.

production of output, and that there is no substitution between different kinds of education in the structure of an occupation. That means the coefficients defining these relations are fixed by technology for a given model run. However, some substitutability undoubtedly does exist. The coefficients represent only one possible way of meeting certain output levels and probably change over time. Runs #5, 6, and 7 were done to gauge the sensitivity of the occupational-educational requirements to changes in these coefficients. They are discussed individually in the following paragraphs.

Run #5: was done using the approximate occupational distribution by industry that existed in 1972. Since these coefficients are likely to become more skill intensive as development proceeds, Run #5 represents a conservative lower bound for the occupation distribution. Table 7 shows that Run #5 requires marginally smaller increases in the Higher and Secondary groups than Run #1, and a 1% average annual higher increase in the Elementary category. Run #5 differs more, however, from Run #1 in the growth in numbers required in each occupation. There are decreases in the more skill intensive occupations and increases in the less skill intensive occupations. This run indicates the scope of one possible way to ease the pressure on the educational system. That is to structure the work force, as much as possible, in ways to keep the required education minimized.

Run #5, which changed all 64 of the coefficients or matrix cells of Table 2, was done as a first step to gauge sensitivity. In practice, however, only key coefficients would be varied. To enhance the model for planning insights, each of the coefficients should be ranked according to a sensitivity scale. The "sensitivity" of a variable refers to how much an incremental change in it affects the output of the entire model. The "sensitivity" for each Table 2 cell will vary and depend on the following:

- The ratio of employment in a particular cell in the occupation-industry matrix (Table 2) to total employment in the occupation. The more even the distribution of this ratio across industries, the smaller will be the proportional change in projected occupational requirements.

- The relative importance of a given occupation in any industry. The projection for occupations which are relatively important in a given industry will tend to be less sensitive to fixed changes in the coefficients.

The projections for occupations with low sensitivity may provide reliable projections of the range of likely developments, and could be used for planning decisions. The projections for occupations with high sensitivity would have to be used more cautiously for planning purposes.

Run #6: Run #1 used the values for the composition of education by occupation that reflect an optimistic increase in the educational composition of each occupation. The values are shown in parentheses in Table 4A. Run #6, done to establish lower bounds for these values in addition to testing for sensitivity, used the estimated 1972 values implying no educational upgrading within the occupations as time goes on. Table 7 shows that, while changing the educational-occupational composition does not affect the total numbers required, it does reduce the Average Annual Increase in each of the first three categories by almost a half. Much of this difference, however, is made up for in the Run #6 Illiterate category, which is probably not realistic, given Iran's literacy goals.

Run #7: includes the changes for both Runs #5 and #6; i.e., the educational structure of occupations (Table 4) and the occupational structure (Table 2) of economic sectors. Its results are the least demanding in terms of the numbers of workers, especially in skilled categories, required to meet economic objectives. For example, the annual growth rates for workers with higher, secondary, and elementary educations were 10%, 7% and 5%, respectively. This run illustrates that it may be theoretically possible to realize the economic expansion indicated in Table 1 with lower demands on the educational system. However, even these lower bound demands are still substantial and require an expansion of the educational system's capacity.

F. MODEL APPLICATION

The results of Run #1 can be used to briefly illustrate the use of the model. To being with, Table 1 projects overall employment growth to around 14 million in 1982. This represents a 5% annual average growth

rate for 1972 and 1982 compared to a historical average rate of approximately 2.2% from 1956 to 1966 based on national census data [2].

It is likely that a growth rate of 5% is infeasible for Iran even given a likely increasing labor force activity rate due to such things as the entrance of more working women. If it is assumed that the 5% is infeasible, several areas would be examined for potential modification. These include questioning whether the growth of sectoral value added will be as fast as forecasted and whether or not sectoral productivity could be increased through special government and for private sector efforts.

One of the benefits of the model is that the disaggregation allows planners to pinpoint those areas requiring specific attention. For example, Run #1's results indicate that the three occupational categories of "professional, technical and related, administrative and managerial, and clerical and related" have forecasted annual growth rates that merit concern even after margins for error are considered. With these results, educational planners would want to make more detailed assessements of the need for specific types of professional, technical, administrative and managerial skills, and make appropriate adjustments to education and training programs. Direct action at the national level would be necessary due to the long lead time and expense required to educate this type of manpower. On the other hand, the concern for clerical occupations need not be translated into direct national-level action. Because of less specific educational requirements, and the short term nature of training in these skills, adjustments in the labor force can be expected to take place through employer operated programs or private, independent institutions. National programs should assure that there are a sufficient number of people with an adequate general education to provide a trainable pool of workers. For example, Run #1 indicates that annual growth rates of 17 and 7 percent are needed at the secondary and elementary levels, respectively, to assure the trainable base.

A few comments must be made concerning data availability. Presently, the high level of aggregation is virtually all that is justified given the lack of good, consistent historical data. The level of aggregation is sufficient, however, to identify potential problem areas. This has

been done above where, even with representative data, large requirements in the clerical, managerial, and professional fields can be seen as serious impediments to economic expansion. The level of aggregation of the present model, unfortunately, does not allow specific quantified recommendations, such as building a specific number of universities, to be made from the output. Rather, the educational planners must use the results as indicators to go into greater depth in potential problem areas. With better data and statistics, the model could be improved to the point that more direct decision making and planning could be done.

An important point to make here is that the "accuracy" of the forecasts, in terms of making exact predictions of the future, is not a critical issue. Rather, the forecasts have be judged in terms of the policy advice to which they lead. The goal is to provide a forecast that, for a given economic plan, reduces the uncertainty of future outcomes to a level that dictates a unique decision by policy makers. If the range of uncertainty in the forecasts is so large that contradictory policy decisions are compatible with it, the forecasts are of little use.